

Claims

- 1 A method of phytoremediating an environment which is  
5 contaminated with at least one heavy metal or oil hydrocarbon,  
which method comprises:  
(a) providing a transgenic plant, which plant expresses at least  
one heterologous nucleic acid encoding an enzyme having  
rhamnosyltransferase activity,  
10 (b) planting or locating said transgenic plant in said environment.
- 2 A method as claimed in claim 1 wherein the environment is  
contaminated with both heavy metal and oil hydrocarbon pollutants.
- 15 3 A method as claimed in claim 1 or claim 2 wherein the plant  
expresses two different heterologous enzymes having  
rhamnosyltransferase activity.
- 4 A method of producing a transgenic plant having improved  
20 phytoremediating properties with respect to heavy metal or oil  
hydrocarbon pollutants, the method comprising:  
(i) introducing into a plant cell a heterologous nucleic acid  
vector encoding at least one enzyme having rhamnosyltransferase  
activity,  
25 (ii) causing or allowing recombination between the nucleic acid  
vector and the plant cell genome to introduce the nucleotide  
sequence encoding the enzyme having rhamnosyltransferase activity  
into the plant genome,  
(iii) regenerating the transformed plant cell into a plant,  
30 such that the or each enzyme is expressed in the plant.
- 5 A method as claimed in claim 4 wherein the vector encodes  
two different enzymes having rhamnosyltransferase activity.
- 35 6 A method as claimed in any one of the preceding claims  
wherein the phytoremediating is either one or both of  
phytostabilizing heavy metal pollutants or phytodegrading oil  
hydrocarbons.

7 A method as claimed in claim 6 wherein the heavy metal is selected from the list consisting of: lead, copper, cadmium, nickel, mercury, arsenic, selenium strontium or zinc.

5 8 A method as claimed in any one of the preceding claims wherein the oil hydrocarbon is crude oil.

9 A method as claimed in any one of the preceding claims wherein the oil hydrocarbon is the C<sub>12</sub>-C<sub>18</sub> hydrocarbon fraction of  
10 crude oil.

10 A method as claimed in any one of the preceding claims wherein the metal accumulation coefficient (C<sub>MA</sub>) of the plant:  
(C<sub>MA</sub> = [C<sub>s</sub>]/[C<sub>r</sub>], where  
15 where the heavy metal is copper present at 1000 mg/kg, and  
C<sub>s</sub> is the copper concentration in shoot, and  
C<sub>r</sub> is the copper concentration in the rhizosphere,  
is less than 20% of that of a corresponding non-transgenic plant,

20 11 A method as claimed in any one of the preceding claims wherein the or each enzyme is involved in the synthesis of monorhamnolipids.

12 A method as claimed in claim 11 wherein the or each enzyme is  
25 selected from the list consisting of: *rhIA* gene or *rhIB* gene.

13 A method as claimed in claim 12 wherein the *rhIA* and *rhIB* gene are derived from a procaryote.

30 14 A method as claimed in claim 13 wherein the *rhIA* and *rhIB* gene are derived from *Pseudomonas aeruginosa*.

15 A method as claimed in any one of the preceding claims wherein the plant is selected from the list consisting of:  
35 *Nicotiana tabacum*; *Arabidopsis thaliana*.

16 A recombinant plant vector which comprises a nucleotide sequence encoding an enzyme having rhamnosyltransferase activity.

17 A vector as claimed in claim 16 wherein the vector encodes two different enzymes having rhamnosyltransferase activity.

5 18 A vector as claimed in claim 16 or claim 17 wherein the or each enzyme is selected from the list consisting of: *rh1A* gene or *rh1B* gene.

19 A vector as claimed in claim 18 wherein the *rh1A* and *rh1B*  
10 gene are derived from a procaryote.

20 A vector as claimed in claim 19 wherein the *rh1A* and *rh1B* gene are derived from *Pseudomonas aeruginosa*.

15 21 A plant host cell containing or transformed with a heterologous vector of any one of claims 16 to 20.

22 A transgenic plant transformed with a heterologous vector of any one of claims 16 to 20, or which is a clone, or selfed or  
20 hybrid progeny or other descendant of said transgenic plant, which in each case expresses at least one heterologous nucleic acid encoding an enzyme having rhamnosyltransferase activity,

23 A plant as claimed in claim 22, wherein the plant is selected  
25 from the list consisting of: *Nicotiana tabacum*; *Arabidopsis thaliana*.

24 Use of a heterologous vector of any one of claims 16 to 20,  
in a method of improving the phytoremediating properties of a plant  
30 with respect to heavy metal or oil hydrocarbon pollutants.